Department of the Army
Pamphlet 40-173

Medical Services

Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard Agents H, HD, and HT

Headquarters
Department of the Army
Washington, DC
XX Month 20XX

SUMMARY OF CHANGE

DA PAM 40-173
Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard Agents H, HD, and HT

This pamphlet is a health-related publication developed to complement existing and future Occupational Safety and Health Administration and safety requirements. It—

- Explains how to request a waiver or exception (para 1-7).

- Presents guidance about exposure limits, engineering controls and work practices, respiratory protection, optical inserts, exposure monitoring, record keeping requirements, hazard communication information, and material safety data sheets (paras 1-5, 3-1, 3-3, 3-4, 4-2, B-1, E-1, E-3, F-1, and F-2; chap 2; and Table 4-1).

- Provides guidance for a medical surveillance program for all personnel potentially exposed to mustard agents H, HD, and HT (paras 1-1, 1-5, 2-2, 3-1, 3-3; chap 4; and app B).

- Provides medical personnel with general information about the diagnosis and treatment of mustard intoxication (paras 4-1 and E-1; app D; and gloss).

- Reduces the number of atmospheric monitoring records that must be maintained in the occupational health record by defining criteria for exposure and potential exposure (para 3-1).

- Explains the roles of the installation or activity commander and competent medical authority or designated contract physician in the medical surveillance program (paras 1-6, 4-5 and 4-6).

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By Order of the Secretary of the Army:

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Official:

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*This pamphlet supersedes DA Pam 40-173, 30 August 1991.

History. This printing publishes a revision of this publication. Because the publication has been extensively revised, the changed portions have not been highlighted.

Summary. This pamphlet explains medical occupational policies and provides procedures pertinent to mustard agents H, HD, and HT. The medical policies and procedures are prescribed in AR 50-6.

Applicability. This pamphlet applies to all Active Army commands, agencies, organizations, and DOD contractors with a mustard agent mission. It does not apply to the Army National Guard or the U.S. Army Reserve.

Proponent and exception authority. The proponent of this pamphlet is The Surgeon General. The Surgeon General has the authority to approve exceptions to this pamphlet that are consistent with controlling law and regulation. The Surgeon General may delegate the approval authority, in writing, to a division chief within the proponent agency who holds the grade of colonel or the civilian equivalent.

Suggested Improvements. Users are invited to send comments and suggested improvements on DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to HQDA (DASG-PPM-NC), 5109 Leesburg Pike, Falls Church, VA 22041-3258.

Distribution. This publication is available in electronic format only (EMO) and is intended for command level __ for the Active Army. This publication is not distributed to the Army National Guard or U.S. Army Reserve.

Contents (Listed by paragraph number)

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A. References

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Glossary

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Chapter 1

Introduction

1-1. Purpose

This pamphlet--

a. Defines the medical surveillance program for all personnel (military and civilian) who have an exposure potential (see glossary) to H, HD, and HT hereinafter referred to as mustard agents (a sub-set of chemical agents) in both storage and in demilitarization. (See AR 50-6 and AR 40-5.)

b. Provides procedures for the evaluation and control of exposures to the mustard agents in storage and used in disposal, non-stockpile (see glossary), training and laboratory operations.

c. Does not apply to battlefield operations, domestic responses to terrorist incidents, outside continental U.S. deployments or low-intensity conflicts.

d. Does not apply to nitrogen mustard compounds (HN-1, HN-2 or HN-3).

1-2. References

Required and related publications and referenced forms are listed in appendix A.

1-3. Explanation of abbreviations and terms

Abbreviations and special terms used in this pamphlet are explained in the glossary.

1-4. Background

This is the first revision of this publication and is intended to reflect the improvements that have occurred in the procedures for—

a. Developing workplace exposure standards.

b. Re-evaluating the supporting database.

c. Changing the associated regulations.

1-5. Goals

The goal of a medical surveillance program supporting mustard agent storage, disposal, non-stockpile, training, and laboratory operations is to limit workplace exposures to mustard agents through the use of engineering controls, work practices, and personal protective equipment (PPE). Ideally, the goal should be zero exposure to mustard agents; however, zero exposure is not always achievable or feasible and is not verifiable in the workplace. The development of occupational health standards, such as airborne exposure limits (AEL), allows the industrial hygienist to measure the safety and healthfulness of the work environment against established criteria, which are protective of human health. These AEL are also used to guide workplace interventions aimed at preventing worker exposures and ensuring individuals who sustain exposures in excess of allowable limits receive appropriate medical evaluations and follow-up.

1-6. Implementation

The installation commander per AR 385-10 is responsible for ensuring compliance with these guidelines. Commanders (or contracting officer's representatives) are also

responsible for incorporating the guidance in this pamphlet into the procurement of contractor services initiated after the effective date of this publication. Preexisting contracts do not require modification.

1-7. Waivers and exceptions

a. As a minimum, submit the following information when requesting a waiver or exception—

(1) The reference to the specific requirement and the specific paragraph for which the waiver or exception is being made.

(2) The reasons why the requirement cannot be met.

(3) The interim measure used that compensates for the inability to comply with the requirement.

(4) The action being taken to meet the requirement, and the estimated date the action will be completed.

(5) A statement of the impact if the waiver or exception is not approved.

b. Forward the request for waiver, extension of waiver, or exception through command channels to HQDA (DASG-PPM-NC), 5109 Leesburg Pike, Falls Church, VA 22041-3258.

1-8. Technical assistance

Contact Commanding General, U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM), ATTN: MCHB-TS-COE, Aberdeen Proving Ground, Maryland 21010-5403 for assistance in implementing the occupational health standards.

For assistance in monitoring, contact Commanding General, USACHPPM, ATTN:

MCHB-TS-O, Aberdeen Proving Ground, Maryland 21010-5403.

Chapter 2

Airborne Exposure Limits and Exposure Monitoring

2-1. Introduction

Airborne exposure limits are developed from available toxicological data to be protective of human health. Both the concentration of a chemical and the duration of exposure determine the dose and therefore the health effect on the worker, so there are different exposure limits based on the duration of exposure. Sensitivity of the population also has an effect so general population limits (GPLs) are lower then worker limits.

2-2. Work practices

The following occupational health practices must be in place during all mustard agent operations.

a. Unprotected individuals shall not be intentionally exposed to--

(1) Airborne mustard agent concentrations exceeding the applicable limits in Table 2-1.

(2) Direct eye or skin contact with any amount of liquid mustard agent.

b. Mustard agent airborne concentrations shall be measured in a manner that allows representative worker exposure profiles to be reconstructed to assess compliance with established AEL.

c. Personnel who have a mustard agent exposure potential (Category A, B, or C) (see chapter 4) shall be enrolled in a mustard agent medical surveillance program that provides appropriate medical evaluation and follow-up.

d. Personnel shall not be assigned to tasks requiring the use of respirators in mustard agent operating areas until a competent medical authority (CMA) (see AR 50-6)--

(1) Performs a medical evaluation (see chapter 4).

(2) Determines whether the individual is medically cleared and able to perform the necessary tasks while wearing a respirator per 29 Code of Federal Regulations Part 1910.134.

2-3. Types of airborne exposure limits

Four types of AEL have been established for mustard agents (see Table 2-1): worker population limits (WPLs), short-term exposure limits (STELs), immediately dangerous to life or health (IDLH) values, and GPLs. Each of these AEL is protective of human health and is used for the following purposes.

a. The WPLs represent the 8-hour time weighted average (TWA) concentration, measured in milligrams per cubic meter (mg/m^3), to which nearly all unprotected personnel may be repeatedly exposed for up to 8 hours per day, 40 hours per week, for a working lifetime, without adverse health effects.

b. The STELs are the concentration to which unprotected personnel can be exposed continuously for a short period of time (that is, up to 15 minutes) without suffering from irritation, chronic or irreversible tissue damage, or narcosis of a sufficient degree to increase the likelihood of accidental injury or impaired self rescue. This concentration should not be exceeded at anytime during the work shift, even if the 8-hour TWA WPLs are not exceeded. Exposures above the WPLs and up to the STELs should be no longer than 15 minutes and should not occur more than four times per day, with at least 60

minutes between successive exposures in this range to protect against accumulative affects.

c. The IDLH values are the—

(1) Maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape impairment or irreversible health effects.

(2) Operational concentration above which the use of a self-contained breathing apparatus (or a combination airline respirator with an auxiliary self-contained breathing apparatus) is required.

d. The GPLs represent the concentration to which nearly all unprotected members of the general population may be exposed indefinitely, 24 hours per day, 7 days a week, for a lifetime, without experiencing adverse health effects. Appendix F provides the toxicologic basis for the derivation of the mustard agent AEL.

2-4. Exposure monitoring

The purposes of exposure monitoring are to protect the worker from developing illnesses from the exposure to a potentially toxic chemical, to assess the effectiveness of engineering controls, and to determine at some future point if the exposures of a group caused some unexpected effect. Monitoring must be quantitative and accurate, and the monitoring records must be maintained.

a. Routine operations

(1) The installation commander, chemical activity commander, or site project manager (This designation also includes the Contracting Officer's Representative at

chemical disposal sites.) shall conduct continuous monitoring per Department of the Army Pamphlet (DA PAM) 385-61 to comply with the AEL in Table 2-1.

(2) Air sampling to evaluate a worker's exposure profile.

(a) The installation commander, chemical activity commander or site project manager shall collect representative general area air samples. Representative samples should be interpreted as meaning low-level monitoring in the personnel's immediate vicinity, at a sufficient number of points to capture the worker's exposure profile during those agent operations and at a sampling height that reflects where the worker's breathing zone is expected to be.

(b) The collection of representative full-period consecutive samples from the breathing zone of individuals performing the agent operation tasks is recommended but not required. Breathing-zone monitoring does not have to be near real-time (NRT) monitoring to be effective, and these samples are not indicated for workers wearing self-contained breathing apparatuses or combination airline respirators with an auxiliary self-contained air supply.

b. New agent operations

(1) Monitor areas with new operations during the first five days to verify the adequacy of engineering controls.

(2) Re-monitor—

(a) Quarterly for one operating day.

(b) Following any significant damage or repairs to the ventilation system.

(c) Following significant changes in the operation.

c. Cleanup after a spill or accidental release. Conduct general area monitoring to confirm that the atmospheric concentrations do not exceed the WPLs in Table 2-1.

d. Exposure measurements. For airborne mustard agent monitoring equipment, use a method of measurement that—

(1) Has an accuracy of plus-or-minus 25 percent at the 95 percent confidence level for the WPLs, STELs, and IDLH values. The data used to comply with the accuracy specification should be limited to the found concentration, generated by the NRT monitor or laboratory instrument used to quantitatively detect mustard agents and the target concentration from the mustard agent challenge standard. This performance specification will be evaluated for each NRT monitor and laboratory instrument. The minimum number of data points to perform this evaluation should be ten or higher. The facility will generate site-specific short-term acceptance criteria to ensure compliance with the accuracy specification or if the number of data points is less than ten.

(2) Demonstrates an accuracy of plus-or-minus 40 percent at the 95 percent confidence level for monitoring mustard agents at the GPLs. The less stringent accuracy specification is due to technological limitations of current sampling and analytical technology. The data used to comply with the accuracy specification will be limited to the found concentration, generated by the laboratory instrument used to quantitatively detect mustard agents, and the target concentration from the mustard agent challenge standard. This performance specification will be evaluated for each laboratory instrument. The minimum number of data points to perform this evaluation should be ten or higher. The facility will generate site-specific short-term acceptance criteria to ensure

compliance with the accuracy specification or if the number of data points is less than ten.

(3) Demonstrates this accuracy and precision over the range of 0.5 to 2.0 times the applicable AEL in Table 2-1.

Table 2-1
Airborne Exposure Limits for Mustard Agents H, HD, and HT (in mg/m^3)*

AEL	H, HD, or HT
WPLs	0.0004
STELs	0.003
IDLH values	2.0
GPLs	0.00002

Notes:

WPLs are an 8-hour TWA.
STELs are a 15-minute TWA.
IDLH values are a ceiling concentration above which the use of a self-contained breathing apparatus is required.
GPLs are a 24-hour TWA.

*Appendix F provides a summary of the toxicologic basis for these values; H or HT is measured as HD.

Chapter 3

Administrative Requirements

3-1. Record keeping

a. General. The occupational and environmental health medical surveillance program as described in AR 40-5 is composed of both general medical and workplace surveillance and job-specific surveillance. The job-specific surveillance is based on the physical requirements and exposure risks of specific jobs. The mustard agent medical surveillance program is a job-specific surveillance program and is a part of the overall occupational and environmental health program. The CMA shall maintain the medical records of personnel enrolled in the mustard agent medical surveillance program in accordance with the requirements of AR 40-66, AR 40-5, and 29 CFR 1910.1020. The medical record should include the results of post-offer, pre-placement; periodic job-related; and termination examinations (see chapter 4 and appendices B and C), as well as respirator screenings/clearances and the results of any mustard agent exposure or potential exposure evaluations. Civilian medical records (x-rays) must be maintained for 40 years or the duration of the individual's employment plus 30 years, whichever is longer. (See AR 40-66, para 7-10a). The remainder of the medical record must be retained for the duration of employment plus 30 years per 29 CFR 1910.1020 (d) (1) (i).

b. Air-monitoring records. Documentation of a worker's exposure potential to mustard agents is important in assessing the present and past exposure history and in documenting compliance with the established AEL listed in Table 2-1.

(1) The installation commander or chemical activity commander designates and assures that the personnel who maintain the air-monitoring records are qualified to interpret, correlate, and forward the results to the CMA. (See DA Pam 385-61, para 3-7a through c.)

(2) The CMA incorporates atmospheric monitoring data on exposed workers or potentially exposed workers (see glossary) into the medical record on Standard Form (SF) 600 (Medical Record – Chronological Record of Medical Care), DA Form 4700 (Medical Record - Supplemental Medical Data), or other appropriate forms. (See Appendix E for criteria for potential exposure.) Any medical record entry of exposure or potential exposure above the WPLs, STELs, or IDLH values prescribed in Table 2-1, shall include—

(a) The date, location, and results of each air sample taken, and whether confirmation of the results was obtained through a second analytical method of detection.

(b) The physical state of the mustard agent, potential route of exposure, time of occurrence, estimated duration of exposure or potential exposure, and type of PPE worn. An example of a medical data sheet that can be used to collect such information is provided in DA Form XX3. (Located at the end of this publication.)

c. Employee access. The CMA—

(1) Provides the affected individuals, former employees, or their designated representatives access to the air-monitoring records associated with exposure or potential exposure evaluations. (See DA Pam 385-61, para 3-7d.)

(2) Makes available the medical records containing the examination content described in paragraph 3-1a for inspection and copying per AR 40-66, AR 50-6, and 29 CFR 1910.1020.

3-2. Information and reporting requirements

a. The installation commander or chemical activity commander, in coordination with other appropriate personnel, provides the following information to the CMA:

(1) A copy of this pamphlet.

(2) A written description of the affected individual's duties as they relate to the mustard agent exposure potential in routine or emergency operations.

(3) The air-monitoring results of an individual's potential exposure, measured or estimated, under the circumstances defined in Appendix E.

(4) A description of any PPE used or to be used.

b. If an individual is removed from work because of signs and symptoms commonly associated with exposure to mustard agents or if the CMA believes that a potential exposure evaluation provides clinical or biochemical evidence of a mustard agent exposure effect, the occurrence should be—

(1) Immediately reported to the installation commander, chemical activity commander, or site project manager or his or her designated representative.

(2) Reported to the certifying official (if a chemical surety related event, see AR 50-6) as potentially disqualifying information.

(3) Documented in the medical record.

(4) Reported through the Reportable Medical Events System as soon as possible after the diagnosis has been made or within 48 hours (applicable to government-operated U.S. Army Medical Department clinics and hospitals only). For information on reporting requirements and procedures, see http://www.amsa.army.mil.

3-3. Employee health education

a. Employee health training. The CMA reviews and concurs or non-concurs with all employee-training materials, standing operating procedures (SOPs), or plans dealing with issues such as contamination avoidance, personal protection, decontamination procedures, buddy-aid, self-aid, and essential first aid practices.

b. Access to health education materials. The CMA coordinates with the installation commander, chemical activity commander, or site project manager to ensure that a copy of all health education materials used in the health education program or training are readily available to all individuals with the potential for exposure.

c. Hazard communication information. Methods of instruction may include formal classes, work area meetings, audiovisual and computer-based presentations as appropriate. As a minimum, the installation commander, chemical activity commander, or site project manager shall annually repeat health-related training as described below.

(1) The installation commander, chemical activity commander, or site project manager, with technical assistance from the CMA, shall, through a written hazard communication program, define the mechanisms for training workers about the exposure potential to mustard agents and the protective measures necessary for the job.

(2) The following mustard agent specific items should be included in the employee hazard communication training—

(a) An explanation of the types of operations in the individual's workplace that have a mustard agent exposure potential.

(b) Methods used by the installation or chemical activity to recognize and evaluate work areas with a mustard agent exposure potential.

(c) An explanation of the potential acute and chronic health effects associated with mustard agent exposure and the purpose and description of the mustard agent medical surveillance program (see Chapter 4 and Appendices B and C).

(d) Protective measures to include administrative and engineering controls, PPE, safe work practices, and emergency procedures to include self-aid, buddy-aid, first aid, and decontamination.

(e) An explanation of the mustard agent material safety data sheets (MSDSs) and applicable SOPs to assure that mustard agent materials are handled and stored per SOPs and DA regulations.

(f) Emergency evacuation and notification procedures.

(3) The CMA shall provide technical assistance, monitor selected training sessions, and approve, in writing, the program of instruction and lesson plans.

(4) The installation commander, chemical activity commander, or site project manager documents hazard communication training, in writing, to include the signature of both the trainee and the approving authority. Document training for all DA employees on Department of Defense (DD) Form 1556 (Request, Authorization, Agreement and

Certification of Training and Reimbursement) or other appropriate forms, and incorporate this documentation permanently in the employee's official personnel folder.

3-4. Material safety data sheets

a. The employee must have direct access to the MSDS' content and location. The MSDS are products of the material developer. To obtain copies of the current MSDS, contact the U.S. Army Soldier, Biological Chemical Command, ATTN: AMSSB-RCB-RS (Safety Office), Building 3330, Aberdeen Proving Ground, MD 21010-5423 or access http://www.sbccom.apgea.army.mil/RDA/msds/index.htm.

b. Since the MSDS' content may change with time, the MSDS may not always represent the medical guidance provided by the Office of The Surgeon General. Questions concerning medical guidance provided in the MSDSs may be addressed to HQDA (DASG-PPM-NC), 5109 Leesburg Pike, Falls Church, VA 22041-3258.

Chapter 4

Mustard Agent Medical Surveillance Program

4-1. Introduction

a. The mustard agent medical surveillance program is part of a comprehensive occupational and environmental health program that preserves health and prevents work-related disease. Medical surveillance may be defined as the ongoing, systematic, evaluation of employees at risk of exposure to achieve early recognition and prevention of clinical disease. The mustard agent medical surveillance program is part of a larger hazard-specific medical surveillance program, which includes other chemical, physical, and biological hazards that have been included by the industrial hygienist on a current inventory of occupational health hazards. When conducting a mustard agent medical surveillance examination, the CMA should also consult the health hazard inventory or industrial hygienist to determine what (if any) other exposures have occurred (or are likely to occur) at or above the action levels established for each chemical or physical hazard. Based on this information, the CMA determines the appropriate medical surveillance questions or test and examination elements for those exposure hazards.

b. The CMA establishes the mustard agent medical surveillance program for personnel with a significant exposure potential to mustard agents (see app B) and assures that employees assigned to one of four medical surveillance categories (A, B, C, or D) by the certifying officials have been enrolled in the mustard agent medical surveillance program. Personnel with a high risk of mustard agent exposure (that is, Category A) will receive

the most extensive examinations. Table 4-1 presents the mustard agent category-specific medical surveillance requirements.

c. Appendix D provides the information on the diagnosis and treatment of mustard agent intoxication.

4-2. Mustard agent medical surveillance categories

The installation certifying official recommends medical surveillance category assignments for all personnel with a mustard agent exposure potential to the CMA, based upon the employees' activities in mustard agent operating areas. This assignment can be found on the chemical duty position roster.

a. Category A includes personnel—

(1) With a high mustard agent exposure potential due to the nature of the agent operations being conducted.

(2) Who may be routinely required (that is, on the average, once a week or four times per month) to make entries or to work for prolonged periods in areas with high concentrations of mustard agent (that is, greater than the IDLH values). These areas also require the use of a self-contained breathing apparatus or a combination airline respirator with an auxiliary self-contained air supply, along with the appropriate dermal protective ensemble.

b. Category B includes personnel with—

(1) A lower mustard agent exposure potential. These individuals are infrequently required (that is, less than once a week) to make entries or to work for prolonged periods in areas with high concentrations of mustard agents (that is, above IDLH values), but may

have periodic activities that require work in mustard agent concentrations between the WPLs and IDLH values. Examples of such activities might include (but are not limited to)—

(a) Hotline or decontamination activities. (See DA Pam 385-61.)

(b) Air-monitoring technician or 3X placed in closed-container monitoring activities.

(c) Maintenance or surveillance operations conducted in mustard agent storage or disposal facilities.

(d) Demilitarization protective ensemble (DPE) stand-by activities.

(e) Chemical accident/incident response by initial response force members.

(2) Job requirements involving the wearing of air-purifying or atmosphere-supplying respirators and dermal protective ensembles during mustard agent training, emergency response exercises, or other related duties.

c. Category C includes personnel—

(1) With minimal probability of exposure to mustard agents except under accident conditions, but whose activities may place them periodically in close proximity to mustard agent operating areas.

(2) Who would not be engaged in activities where concentrations of mustard agent would exceed the WPLs and would likely be required to wear respiratory protective equipment only for emergency egress.

d. Category D includes—

(1) Transient visitors to mustard agent operating areas where there is an extremely limited exposure potential. An example of this visitor would be personnel required to

observe, review or inspect activities within a chemical exclusion area (in storage or disposal facilities) where the use of engineering controls does not completely preclude the risk of accidental exposure. (NOTE: Casual visitors receiving familiarization or orientation tours through facilities where mustard agent operations are not ongoing or where exposures have been precluded by engineering controls NEED NOT be assigned to category D.)

(2) Laboratory personnel working with research, development, test and evaluation dilute solutions of mustard agents.

4-3. Medical surveillance examinations

Four examinations may be conducted as part of the mustard agent medical surveillance program. These include post-offer, pre-placement; periodic job-related; and termination, as well as post exposure and potential exposure evaluations.

4-4. Post-offer, pre-placement examinations

a. All personnel assigned to work in areas with a mustard agent exposure potential shall receive a post-offer, pre-placement medical surveillance examination to—

(1) Document that the employee—

(a) Does not exhibit physical, mental, or emotional impairments that may result in a higher vulnerability to mustard agent exposure.

(b) Is physically and mentally able to wear and use the required PPE.

(2) Establish the employee's baseline health status, particularly for organ systems that may be affected by exposure to mustard agents.

(3) Assess the employee's functional capacity to perform specific work-related tasks.

(4) Identify any medical conditions for which recommended work restrictions, limitations, or reasonable accommodations are appropriate under the provisions of 29 CFR 1630.

b. This examination should be performed by or under the supervision of the CMA and at no cost to the employee. See appendix B, section I for the examination's requirements by medical surveillance category.

c. An acceptable post offer, pre-placement examination is any medical examination that is--

(1) Conducted within 90 days prior to work assignment to an area involving the potential exposure to mustard agents. If this examination was not conducted specifically as a post offer, pre-placement examination, the CMA should review the examination results and render a written opinion in the medical record as to its acceptability as a post offer, pre-placement examination.

(2) Consistent with the requirements outlined in Appendix B, section I. If the examination does not include all of the requirements, the CMA should perform the procedures that were omitted.

4-5. Periodic job-related examinations

a. The installation commander or chemical activity commander assures that all personnel assigned to work in areas with an exposure potential to mustard agents receive the appropriate periodic job-related examinations. Appendix B, section II, details the periodic examination requirements by medical surveillance category. The CMA

performs the appropriate category-specific, periodic examination and informs the certifying official of those individuals who do not have current periodic examinations.

b. Periodic job-related examinations are—

(1) Usually performed on an annual basis.

(2) Conducted to document any change in the employee's health status, particularly with respect to specific exposure hazards encountered in the workplace over the intervening year.

(3) Designed to screen for mustard agent exposure effects and to assess the employee's physical capacity to perform essential job functions. Using the data gathered from these examinations, the CMA may discover correlations between workplace exposures to mustard agents and specific health endpoints by comparing the employee to—

(a) Himself or herself over time.

(b) Groups of workers with greater or lesser degrees of exposure.

4-6. Termination examinations

a. The CMA performs a termination examination on individuals within 30 days before or after removal from the mustard agent medical surveillance program. The examination documents the employee's health status at the time of termination, particularly for organ systems that may have been affected by mustard agent exposure. Appendix B, section III details the termination examination requirements by medical surveillance category.

b. Termination examinations do not have to be conducted on individuals who have been enrolled in the mustard agent medical surveillance program for three months or less, unless—

(1) Documented evidence of exposure to mustard agents (that is, clinical signs or symptoms consistent with a mustard agent exposure effect) exists.

(2) A potential exposure evaluation has been conducted within the three-month time period.

c. The installation commander or chemical activity commander ensures that a termination examination has been administered or offered to workers who—

(1) Have been enrolled in the mustard agent medical surveillance program for more than three months.

(2) Have been permanently disqualified or administratively terminated from the chemical personnel reliability program (PRP) and who no longer have mustard agent exposure potential. (See AR 50-6, paragraph 2-21.)

4-7. Post exposure and potential exposure evaluations

This pamphlet requires medical evaluations be performed in the event of accidental exposure or potential exposure to mustard agents. In the past, the criteria used to identify potential exposures have varied between chemical weapon storage and disposal sites. This variability has led to different implementation criteria for event-driven medical examinations. If an individual has been potentially exposed (see Appendix E), the CMA will--

a. Obtain information concerning the circumstances of the exposure or potential exposure and provide the appropriate medical examinations and emergency treatment as needed (see DA Form XX1, DA Form XX2, and DA Form XX3, located at the end of this publication).

b. Document in the medical record the results of the examination and an opinion as to whether a mustard agent exposure (see glossary) has occurred.

c. Record any air-monitoring measurements in the medical record (see para 3-1b(2)). See DA Form XX3 for the content of a mustard agent exposure and potential exposure evaluation.

4-8. Documentation of medical opinions

The CMA records a written opinion in the medical record for each medical examination. This opinion includes—

a. The results of the medical examination and testing.

b. A statement about any detected medical condition that would place the individual's health at an increased risk of impairment if exposed to mustard agents.

c. Any recommended limitations on the potential exposure to mustard agents or on the use of PPE.

d. A statement that the employee has been informed of the above.

Table 4-1
Category specific medical surveillance[1]

Category	Post-offer, pre-placement	Periodic[2]	Termination
A	Occupational history (OH) Medical history (MH) Physical examination (PE) Electrocardiogram (EKG) PPE evaluation (includes spirometry) Audiometric examination Visual acuity Pupillary reactivity Chest x-ray Complete blood count (CBC) with differential (diff)	Interval OH Interval MH PE EKG (every 5 years) PPE evaluation (spirometry every 2 years) Visual acuity Pupillary reactivity CBC with diff (every 2 years) Audiometric exam	Interval OH Interval MH PE Spirometry Chest x-ray CBC with diff
B	Same as category A	Same as category A, except spirometry and CBC are done every 5 years or more. Frequency at discretion of the CMA or contract medical director	Same as category A
C	OH MH Respirator questionnaire as required[3]	Interval OH/MH Respirator questionnaire as required[3]	Interval OH/ MH Respirator questionnaire as required[3]
D	Respirator questionnaire as required[3]	Respirator questionnaire as required[3]	Respirator questionnaire as required[3]

[1]See Appendix B for detailed guidance.
[2]Denotes annual requirement, unless otherwise mentioned.
[3]Category C and D employees entering mustard agent operating areas may be issued military respirators or emergency escape devices for emergency egress. Under provisions of 29 CFR 1910.134 all individuals issued respiratory protection must be medically evaluated to ensure that they are physiologically and psychologically able to wear the respirators for the intended tasks. Respirator clearance evaluations should be added to the scope of the mustard agent medical surveillance examination under these circumstances. See Appendix C and DA Form XX2.

Appendix A
References

Section I
Required Publications

AR 385-10
The Army Safety Program (cited in para 1-6)

AR 40-5
Preventive Medicine (cited in paras 1-1a, 3-1a, B-5b, and B-6)

AR 40-66
Medical Record Administration and Health Care Documentation (cited in paras 3-1a, 3-1c, B-14b, and B-14c)

AR 50-6
Chemical Surety (cited in paras 1-1a, 2-2d, 3-1c, 3-2b, 4-6c, B-1c, B-4d, and E-2c)

DA PAM 385-61
Toxic Chemical Agent Safety Standards (cited in paras 2-4a, 3-1b, 3-1c, and 4-2b)

TB MED 296
Assay Techniques for Detection of Exposure to Sulfur Mustard, Cholinesterase Inhibitors, Sarin, Soman, GF, and Cyanide (cited in paras B-12, D-1 and D-5b)

Section II
Related Publications

A related publication is merely a source of additional information. The user does not have to read it to understand this regulation.

AR 11-34
The Army Respiratory Protection Program

AR 385-61
The Army Chemical Agent Safety Program

DA PAM 40-501
Hearing Conservation Program

DA PAM 40-503
Industrial Hygiene Program

DA PAM 40-506
The Army Vision Conservation and Readiness Program

DA PAM 50-6
Chemical Accident or Incident Response and Assistance (CAIRA) Operations

TB MED 502/DALM 1000.2
Respiratory Protection Program

TB MED 509
Spirometry in Occupational Health Surveillance

29 CFR 1630
Regulations to Implement the Equal Employment Provisions of the Americans with Disabilities Act. Available from http://www4.law.cornell.edu/cfr/29p1630.htm

29 CFR 1910.1020
Access to Employee Exposure and Medical Records (Copies are available from the http://www.osha-slc.gov/OshStd_data/1910_11020.html)

29 CFR 1910.134
Respiratory Protection (Available from http://www.osha-slc.gov/OshStd_data/1910_0134.html

53 FR 8504
Final Recommendations for Protecting the Health and Safety Against Potential Adverse Effects of Long-Term Exposure to Low Doses of Agents: GA, GB, VX, Mustard Agent (H, HD, T), and Lewisite (L)

Unnumbered publication
Anderson, J.S. The Effect of Mustard Gas Vapour on Eyes Under Indian Hot Weather Conditions, 1942

Unnumbered publication
CDRE Report No. 241. Chemical Defense Research Establishment (India)

Unnumbered publication
Guild, W.J.F., K.P. Harrison, A. Fairley, and A.E. Childs. The Effect of Sulfur Mustard on the Eyes, 1941

Unnumbered publication
Reed, C.I. The Minimum Concentration of Mustard Gas Effective for Man (Preliminary Report No. 318), 1918

Unnumbered publication
Reed et al. The Minimum Concentration of Mustard Gas Effective for Man (Final Report No. 329), 1918

Unnumbered publication
McNamara et al. Toxicological Basis for Controlling Levels of Mustard in the Environment, 1975

USACHPPM Technical Report 47-EM-3767-01
Evaluation of Airborne Exposure Limits for Sulfur Mustard: Occupational and General Population Exposure Criteria, 2000

Section III
Referenced Forms

DA Form 4700
Medical Record - Supplemental Medical Data (cited in para 3-1b and app C).

DD Form 1556
Request, Authorization, Agreement, and Certification of Training and Reimbursement (cited in para 3-3c)

SF 507
Clinical Record (cited in app C).

SF 600
Medical Record – Chronological Record of Medical Care (cited in para 3-1b).

Section IV
Prescribed Forms

DA Form XX1
Written Recommendation for Use of Respiratory Protective Devices

DA Form XX2
Medical Clearance for Respirator Use

DA Form XX3
Potential Exposure Evaluation Data Sheet and Clinical Record

Appendix B

Medical Surveillance Program for Personnel with a Significant Exposure Potential to Mustard Agents

Section I

Post-Offer, Pre-Placement Examinations

B-1. Categories A and B personnel

The CMA—

a. Obtains a comprehensive—

(1) Occupational history, with specific emphasis on prior potential exposures to skin contact irritants (for example, petroleum distillates, coal tar solvents, chlorinated hydrocarbons, alcohols, glycols, ketones or acetates) or contact allergens (such as, nickel, chromate, epoxy resins, phenolic resins, rubber antioxidants or accelerators, biocides, organic dyes or amines). Inquire as to any past exposures to—

(a) Alkylating agents.

(b) Eye, nose or sinus irritants.

(c) Pulmonary intoxicants.

(d) Developmental toxins.

(e) Chemicals associated with peripheral or central nervous system (CNS) effects.

(2) Medical history and review of systems, to include the Occupational Safety and Health Administration Respirator Questionnaire or equivalent (see Appendix C), focusing

on the skin, eyes, nose/throat, pulmonary, cardiovascular, neurologic and reproductive systems.

b. Administers a general PE—

(1) With emphasis on the identification of any work-limiting conditions requiring reasonable accommodations or work restrictions, particularly with regard to having the ability to wear PPE.

(2) To detect any significant abnormalities in visual acuity or hearing or abnormalities of the skin or cardiovascular, pulmonary or neurologic systems, which might make the individual more susceptible to the effects of mustard agents.

c. Performs specific evaluations to include a (an)—

(1) Electrocardiogram at rest. At the discretion of the CMA, an individual may obtain an exercise tolerance test (that is, stress EKG) if the individual is to perform strenuous activities using PPE.

(2) Evaluation of the individual's physical ability to perform work involving potential exposure to mustard agents using the required dermal and respiratory protective ensembles (PPE). This evaluation uses reliable evidence such as history (for example, recent successful completion of a mask confidence exercise) or observations (for example, a use test) that show the individual can safely and effectively use the required PPE and that no physiological or psychological conditions impair the individual's ability to use this equipment. For this evaluation, document this evidence and the written medical opinion of the individual's ability to use such equipment in the individual's medical record.

(a) In addition to reviewing the worker's responses to the OSHA Respirator Questionnaire, the CMA must document baseline pulmonary function tests including, as a minimum, the forced vital capacity and the 1-second forced expiratory volume. (See TB MED 509.) Abnormal pulmonary function tests alone are not grounds for disqualification. If there are abnormal pulmonary function tests, consider the following before disqualifying an individual from respiratory PPE use: The individual's MH and age; the nature of the work to be performed while wearing respiratory PPE; the type of respiratory PPE employed; the results of the tests of cardiovascular status; and if necessary, a use test.

(b) The CMA must inform the certifying official, in a confidential manner, about any individual in the chemical PRP who appears to be physically or psychologically unable to wear dermal or respiratory protective ensembles (See AR 50-6, para 2-8e.) If work practices require activities to be performed in full protective clothing (that is, air-purifying or atmosphere-supplying respirators with an encapsulating protective ensemble), document the individual's ability to withstand heat stress in the medical record and enroll the individual in a heat stress prevention program.

(3) Audiometric examination to determine the individual's auditory acuity per DA PAM 40-501.

(4) Determination of the near and distant visual acuity and pupillary reactivity.

(a) All individuals will have corrected near and distant visual acuity of 20/40 or better in at least one eye. If corrective lenses are required to provide this acuity, order the lenses before the individual's placement in the workplace.

(b) Provide individuals working in eye hazardous areas or jobs with appropriate protective eyewear (see DA PAM 40-506), to include, but not limited to, prescription and plano-industrial safety glasses and chemical splash goggles.

(c) Instruct individuals on the importance of wearing eyewear and the proper use of these items (whether protective or merely to correct visual acuity), including optical inserts for the protective mask (if required).

(5) Other clinical tests include a 14- by 17-inch posterior-anterior chest radiograph and a CBC with differential white cell count.

B-2. Category C personnel

a. No post-offer, pre-placement examination is required; however, the CMA should obtain a comprehensive OH with specific emphasis on prior potential exposures to skin contact irritants and allergens.

b. The CMA should also obtain a MH and a review of systems, focusing on the skin and eyes, cardiovascular, pulmonary, neurologic and psychiatric systems.

c. If the individual may be issued a military respirator or emergency escape device for emergency egress, the individual will complete the OSHA Respirator Questionnaire provided in Appendix C, and the CMA should render and document a medical opinion as to the individual's ability to safely wear a respirator for emergency egress purposes.

B-3. Category D personnel

No post-offer, pre-placement examination is necessary. However, if a respirator or emergency-escape device is to be issued to the worker for emergency egress purposes, the individual will complete the OSHA Respirator Questionnaire contained in Appendix C.

B-4. Abnormal findings

In the event of abnormal findings on the post-offer, pre-placement examination, the CMA—

a. Determines what (if any) functional activity or PPE limitations are necessary to protect the health of the worker.

b. Discusses limitations with the worker after reviewing the worker's job description.

c. Informs the worker's supervisor of any work restrictions or reasonable accommodations that might be necessary to protect the health of the worker or to allow him or her to accomplish the essential functions of their job.

d. Informs the certifying official in a confidential manner of any potentially disqualifying information if the worker is in the chemical PRP, along with the appropriate recommendation for restriction or disqualification. (See AR 50-6, para 2-15a(4).)

Section II

Periodic Job-Related Examinations

B-5. Categories A and B personnel

a. All workers in Categories A and B will receive an annual job-related examination to determine continued fitness and to review occupational exposure histories during the preceding year.

(1) Pay special attention to the possibility of non-occupationally related exposures to other substances producing effects similar to mustard agent effects, such as skin contact irritants and allergens.

(2) Obtain a complete MH of signs, symptoms, or adverse effects that may be connected to mustard agent exposure, heat stress, or continued use of PPE.

b. As a minimum, the CMA will review and update the occupational and medical histories, in addition to the examinations listed in paragraphs B-1b and B-1c(1) through (4). The one exception is that EKGs are required only once every five years.

(1) Spirometry results and CBC with differential are obtained every 2 years for category A personnel and every 5 years for category B personnel.

(2) The tests in Table 4-1 should supplement other hazard-specific medical surveillance tests indicated by worker exposures (if any) to substances other than mustard agents that are listed on the health hazard inventory. (See AR 40-5, para 5-9a.)

B-6. Category C personnel

For workers designated in Category C, the CMA will take an interval work history, MH and review of systems, focusing on any signs, symptoms, or adverse effects that may be connected to exposure to mustard agents or other skin contact irritants or allergens. A periodic/annual job-related examination is not necessary. Instruct individuals who continue to wear respirators for emergency egress purposes to complete the OSHA Respirator Questionnaire. (See Appendix C.) The mustard agent examination's content should supplement other hazard-specific medical surveillance tests indicated by worker exposures (if any) to substances other than mustard agent that are listed on the health hazard inventory (see AR 40-5, para 5-9a).

B-7. Category D personnel

A periodic job-related examination is not required. If a respirator clearance is required, the individual should complete the OSHA Respirator Clearance Form contained in Appendix C.

B-8. Abnormal findings

In the event of abnormal findings on the periodic job-related examination, the CMA—

a. Determines what (if any) functional activity or PPE limitations are necessary to protect the health of the worker.

b. Discusses the limitations with the worker after reviewing the worker's job description.

c. Informs the worker's supervisor of any work limitations or reasonable accommodations that will be needed to protect the health of the worker or to allow him or her to accomplish the essential functions of the job.

d. Informs the certifying official in a confidential manner of any potentially disqualifying information, along with the appropriate recommendation for restriction or disqualification if the worker is in the chemical PRP.

Section III

Termination Examinations

B-9. Categories A and B personnel

The CMA will update the occupational exposure history and medical review of systems as previously described in paragraph B-5. If as a result of any of the previous examinations, the individual was referred for specialty consultation, the CMA should refer the individual again for follow-up evaluation. A termination PE, spirometry, chest radiograph, and CBC with differential white cell count should be obtained.

B-10. Category C personnel

The CMA will update the occupational exposure history and medical review of systems as previously described in paragraph B-6. A termination examination is not needed before termination of employment.

B-11. Category D personnel

A termination examination is not required.

Section IV

Post Exposure and Potential Exposures

B-12. Evaluation of Workers with Skin Erythema and Blisters in the Setting of Potential Exposure to Mustard Agents in the Workplace

In a occupational health setting where the patient presents with characteristic skin redness followed by blistering after work activities in a mustard agent operating area, the CMA or contract medical director should consider obtaining urine samples for detection of thiodiglycol as described in TB MED 296. Blood assays for thiodiglycol and tissue specimens for histopathology or detection of deoxyribonucleic acid (DNA) adducts may also be helpful in confirming the clinical diagnosis of sulfur mustard exposure.

a. The collection of urine samples needs to be done under close supervision by a healthcare provider to preclude the possibility of sample tampering. Clean urine cups should be provided for the collection. Immediately transfer 30 milliliters of urine to a plastic sample tube or container. Leave enough air space in the container to allow for the expansion of liquid contents in the frozen state. Sample containers made of non-breakable plastic, which can withstand cryogenic temperatures, need to be used during shipping. The urine should be collected immediately following suspected exposure. If possible, two additional urine specimens, with 30-milliliter aliquots, need to be obtained one (1) day, two (2) days, three (3) days, and seven (7) days after exposure. The clinic

should also provide a 30-milliliter urine sample obtained from a known unexposed individual to serve as a control.

b. At least 2 cubic centimeters of blood should be drawn into a vacutainer containing ethylenediaminetetraacetic acid as an anticoagulant. Blood samples need to be kept refrigerated and shipped with adequate ice packs. When only small, limited skin contact with mustard agent occurs, it is very difficult to detect the presence of metabolites in blood or urine specimens. The excised skin of the blister or a small 3 to 5-millimeter punch biopsy of the exposed area will greatly enhance the chance of positive identification.

c. Immediately freeze the skin sample without any preservative in a clean, sealed tube. A tamper proof strip with the patient's name, social security number, and the time and date of collection should be placed across each tube or container with the patient's initials. A memorandum needs to be included with the specimens, providing information on the time of suspected exposure, onset time of symptoms/signs (if any), possible mustard agents involved, patient's age and gender, as well as the CMA or contract medical director's name, address, and phone number. All sealed containers need to be shipped in dry ice by overnight delivery to the U.S. Army Medical Research Institute of Chemical Defense, ATTN: MCMR-UV-PA, Applied Pharmacology Branch, 3100 Ricketts Point Road, Aberdeen Proving Ground, MD 21010-5400. If immediate shipment is not possible, urine, blood and tissue specimens need to be kept frozen.

Appendix C
Medical Evaluation of Respirator Wearers and Potential Exposures to Mustard Agents

Section I
The OSHA Respirator Questionnaire

MEDICAL RECORD—SUPPLEMENTAL MEDICAL DATA

For use of this form see AR 40-66; the proponent agency is the Office of The Surgeon General

REPORT TITLE

OSHA RESPIRATOR QUESTIONNAIRE

OTSG APPROVED *(Date)*

1. Your age (to nearest year):

2. Sex (circle one): Male/Female

3. Your height: ft. in.

4. Your weight: lbs.

5. Your job title:

6. A phone number where you can be reached by the healthcare professional who reviews this questionnaire (include the Area Code):

7. The best time to phone you at this number:

8. Has your employer told you how to contact the healthcare professional who will review this questionnaire (circle one): Yes/No

9. Check the type of respirator you will use (You can check more than one category, if applicable):

a. N. R. or P disposable respirator (filter-mask, non-cartridge type only).

b. Other type (for example, half- or full-face piece type, powered-air purifying, supplied-air, self-contained breathing apparatus).

10. Have you worn a respirator (circle one): Yes/No

If "yes," what type(s):

Part A. Section 2. (Mandatory) Questions 1 through 9 below must be answered by every employee who has been selected to use any type of respirator (please circle "yes" or "no").

1. Do you currently smoke tobacco or have you smoked tobacco in the last month: Yes/No

2. Have you ever had any of the following conditions?

a. Seizures (fits): Yes/No

b. Diabetes (sugar disease): Yes/No

(continued top of next column)

c. Allergic reactions that interfere with your breathing: Yes/No

d. Claustrophobia (fear of closed-in places): Yes/No

e. Trouble smelling odors: Yes/No

3. Have you ever had any of the following pulmonary or lung problems?

a. Asbestosis: Yes/No

b. Asthma: Yes/No

c. Chronic bronchitis: Yes/No

d. Emphysema: Yes/No

e. Pneumonia: Yes/No

f. Tuberculosis: Yes/No

g. Silicosis: Yes/No

h. Pneumothoraz (collapsed lung): Yes/No

i. Lung cancer: Yes/No

j. Broken ribs: Yes/No

k. Any chest injuries or surgeries: Yes/No

1. Any other lung problem that you've been told about: Yes/No

4. Do you currently have any of the following symptoms of pulmonary or lung illness?

a. Shortness of breath: Yes/No

b. Shortness of breath when walking fast on level ground or walking up a slight hill or incline: Yes/No

c. Shortness of breath when walking with other people at an ordinary pace on level ground: Yes/No

(continued top of next column)

d. Have to stop for breath when walking at your own pace on level ground: Yes/No

e. Shortness of breath when washing or dressing yourself: Yes/No

f. Shortness of breath that interferes with your job: Yes/No

g. Coughing that produces phlegm (thick sputum): Yes/No

h. Coughing that wakes you early in the morning: Yes/No

i. Coughing that occurs mostly when you are lying down: Yes/No

j. Coughing up blood in the last month: Yes/No

k. Wheezing: Yes/No

l. Wheezing that interferes with your job: Yes/No

m. Chest pain when you breath deeply: Yes/No

n. Any other symptoms that you think may be related to lung problems: Yes/No

5. Have you ever had any of the following cardiovascular or heart problems?

a. Heart attack: Yes/No

b. Stroke: Yes/No

c. Angina: Yes/No

d. Heart failure: Yes/No

e. Swelling in your legs or feet (not caused by walking): Yes/No

f. Heart arrhythmia (heart beating irregularly): Yes/No

g. High blood pressure: Yes/No

(Continue on reverse)

PREPARED BY:*(Signature & Title)* | DEPARTMENT/SERVICE/CLINIC | DATE

PATIENT'S IDENTIFICATION *(For typed or written entries give: Name—last, first, middle; grade; date; hospital or medical facility)*

☐ HISTORY/PHYSICAL ☐ FLOW CHART

☐ OTHER EXAMINATION OR EVALUATION ☐ OTHER *(Specify)*

☐ DIAGNOSTIC STUDIES

☐ TREATMENT

*U.S. Government Printing Office:1994 — 300727/10398

5. Have you ever had any of the following cardiovascular or heart problems? (Cont'd)

h. Any other heart problem that you've been told about: Yes/No

6. Have you ever had any of the following cardiovascular or heart symptoms?

a. Frequent pain or tightness in your chest: Yes/No

b. Pain or tightness in your chest during physical activity: Yes/No

c. Pain or tightness in your chest that interferes with your job: Yes/No

d. In n the past two years, have you noticed your heart skipping or missing a beat: Yes/No

e. Heartburn or indigestion that is not related to eating: Yes/No

f. Any other symptoms that you think may be related to heart or circulation problems: Yes/No

7. Do you currently take medication for any of the following problems?

a. Breathing or lung problems: Yes/No

b. Heart trouble: Yes/No

c. Blood pressure: Yes/No

d. Seizures (fits): Yes/No

8. If you've used a respirator, have you ever had any of the following problems? (If you've never used a respirator, check the following space and go to question 9:)

a. Eye irritation: Yes/No

b. Skin allergies or rashes: Yes/No

c. Anxiety: Yes/No

d. General weakness or fatigue: Yes/No

e. Any other problem that interferes with your use of a respirator: Yes/No

9. Would you like to talk to the healthcare professional who will review this questionnaire about your answers to this questionnaire: Yes/No

Questions 10 to 15 below must be answered by every employee who has been selected to use either a full-face piece respirator or a self-contained breathing apparatus (SCBA). For employees who have been selected to use other types of respirators, answering these questions is voluntary.

(continued top of next column)

10. Have you ever lost vision in either eye (temporarily or permanently): Yes/No

11. Do you currently have any of the following vision problems?

a. Wear contact lenses: Yes/No

b. Wear glasses: Yes/No

c. Color blind: Yes/No

d. Any other eye or vision problem: Yes/ No

12. Have you ever had an injury to your ears, including a broken ear drum: Yes/No

13. Do you currently have any of the following hearing problems?

a. Difficulty hearing: Yes/No

b. Wear a hearing aid: Yes/No

c. Any other hearing or ear problem: Yes/ No

14. Have you ever had a back injury: Yes/No

15. Do you currently have any of the following musculoskeletal problems?

a. Weakness in any of your arms, hands, legs, or feet: Yes/No

b. Back pain: Yes/No

c. Difficulty fully moving your arms and legs: Yes/No

d. Pain or stiffness when you lean forward or backward at the waist: Yes/No

e. Difficulty fully moving your head up or down: Yes/No

f. Difficulty fully moving your head side to side: Yes/No

g. Difficulty bending at your knees: Yes/No

h. Difficulty squatting to the ground: Yes/ No

i. Climbing a flight of stairs or a ladder carrying more than 25 lbs: Yes/No

j. Any other muscle or skeletal problem that interferes with using a respirator: Yes/No

(continued top of next column)

Part B: Any of the following questions, and other questions not listed, may be added to the questionnaire at the discretion of the healthcare professional who will review the questionnaire.

1. In your present job, are you working at high altitudes (over 5,000 feet) or in a place that has lower than normal amounts of oxygen: Yes/No

If "yes," do you have feelings of dizziness, shortness of breath, pounding in your chest, or other symptoms when you're working under these conditions: Yes/No

2. At work or at home, have you ever been exposed to hazardous solvents, hazardous airborne chemicals (e.g., gases, fumes, or dust), or have you come into skin contact with hazardous chemicals: Yes/No

If "yes," name the chemicals if you know them:

3. Have you ever worked with any of the materials, or under any of the conditions, listed below:

a. Asbestos: Yes/No

b. Silica (e.g., in sandblasting): Yes/No

c. Tungsten/cobalt (e.g., grinding or welding this material): Yes/No

d. Beryllium: Yes/No

e. Aluminum: Yes/No

f. Coal (for example, mining): Yes/No

g. Iron: Yes/No

h. Tin: Yes/No

i. Dusty environments: Yes/No

j. Any other hazardous exposures: Yes/No

If "yes," describe these exposures:

4. List any second jobs or side businesses you have:

5. List your previous occupations:

6. List your current and previous hobbies:

7. Have you been in the military services? Yes/No

If "yes," were you exposed to biological or chemical agents (either in training or combat): Yes/No

8. Have you ever worked on a HAZMAT team? Yes/No

(continued top of next page)

CLINICAL RECORD

~~Report on~~ ~~S.F.~~ _____

or

Continuation of DA 4700 RESPIRATORY MEDICAL QUESTIONNAIRE

(Strike out one line) (Specify type of examination or data)

(Sign and date)

9. Other than medications for breathing and lung problems, heart trouble, blood pressure, and seizures mentioned earlier in this questionnaire, are you taking any other medications for any reason (including over-the-counter medications): Yes/No

If "yes," name the medications if you know them:

10. Will you be using any of the following items with your respirator(s)?

a. HEPA Filters: Yes/No

b. Canisters (for example, gas masks): Yes/ No

c. Cartridges: Yes/No

11. How often are you expected to use the respirator(s) (circle "yes" or "no" for all answers that apply to you):

a. Escape only (no rescue): Yes/No

b. Emergency rescue only: Yes/No

c. Less than 5 hours per week: Yes/No

d. Less than 2 hours per day: Yes/No

e. 2 to 4 hours per day: Yes/No

f. Over 4 hours per day: Yes/No

12. During the period you are using the respirator(s), is your work effort:

a. Light (less than 200 kcal per hour): Yes/ No

(continued top of next column)

If "yes," how long does this period last during the average shift: hrs. mins.

Examples of a light work effort are sitting while writing, typing, drafting, or performing light assembly work; or standing while operating a drill press (1 - 3 lbs.) or controlling machines.

b. Moderate (200 to 350 kcal per hour): Yes/No

If "yes," how long does this period last during the average shift: hrs. mins.

Examples of moderate work effort are sitting while nailing or filing; driving a truck or bus in urban traffic; standing while drilling, nailing, performing assembly work, or transferring a moderate load (about 35 lbs.) at trunk level; walking on a level surface about 2 mph or down a 5-degree grade about 3 mph; or pushing a wheelbarrow with a heavy load (about 100 Lbs) on a level surface.

c. Heavy (above 350 kcal per hour): Yes/ No

If "yes," how long does this period last during the average shift: hrs. mins.

Examples of heavy work are lifting a heavy load (about 50 lbs.) from the floor to your waist or shoulder; working on a loading dock shoveling: standing while bricklaying or chipping castings; walking up an 8-degree grade about 2 mph; climbing stairs with a heavy load (about 50 Lbs).

13. Will you be wearing protective clothing and/or equipment (other than the respirator) when you're using your respirator: Yes/No

If "yes," describe this protective clothing and/or equipment:

(continued top of next column)

14. Will you be working under hot conditions (temperature exceeding 77° F: Yes/No

15. Will you be working under humid conditions: Yes/No

16. Describe the work you'll be doing while you're using your respirator(s):

17. Describe any special or hazardous conditions you might encounter when you're using your respirator(s) (for example, confined spaces, life-threatening gases):

18. Provide the following information, if you know it, for each toxic substance that you'll be exposed to when you're using your respirator(s):

Name of the first toxic substance:

Estimated maximum exposure level per shift:

Duration of exposure per shift

Name of the second toxic substance:

Estimated maximum exposure level per shift:

Duration of exposure per shift:

Name of the third toxic substance:

Estimated maximum exposure level per shift:

Duration of exposure per shift:

The name of any other toxic substances that you'll be exposed to while using your respirator:

(Continue on reverse side)

PATIENT'S IDENTIFICATION *(For typed or written entries give: Name – last, first, middle; grade; date; hospital or medical facility)*

REGISTER NO.

WARD NO.

~~REPORT ON~~ _____or CONTINUATION OF DA 4700____

Standard Form 507
GENERAL SERVICES ADMINISTRATION AND
INTERAGENCY COMMITTEE ON MEDICAL RECORDS
FPMR 101-11 .80 6-8
OCTOBER 1975 507-106

Appendix D

Diagnosis and Treatment of Mustard Agent Intoxication

D-1. General

In an occupational health setting where the patient presents with characteristic skin redness followed by blistering after work activities in a mustard agent operating area, the CMA should consider obtaining urine samples for detection of thiodiglycol as described in TB MED 296, Chapter 2. Blood assays for thiodiglycol and tissue specimens for histopathology or detection of DNA adducts may also be helpful in confirming the clinical diagnosis of sulfur mustard exposure.

D–2. Routes of entry

The routes of entry are through eye/skin contact, inhalation, or ingestion.

a. Mustard agents are oily liquids with the consistency of motor oil; these agents exhibit low volatility under temperate conditions. Sulfur mustard has the odor of mustard, garlic or horseradish, which may be detected by the human nose at concentrations as low as 2 to 10 mg/m^3. The vapor density of sulfur mustard is 5.4 times that of air; mustard vapors will normally be found near the ground or floor following a release into undisturbed air.

b. Liquid mustard is somewhat heavier than water, although droplets may remain on the surface of water. Mustard agents are relatively insoluble in water; however, once they go into solution, they are hydrolyzed rapidly. Sulfur mustard is extremely soluble in fats and lipids and will penetrate intact skin within several minutes. Warm, moist

intertriginous areas, where the skin temperature and relative humidity are high, are particularly susceptible to mustard penetration and biologic effects.

c. Sulfur mustard is considered a persistent chemical agent, in that it will remain on contaminated surfaces for long periods of time under cool temperatures; distilled mustard freezes at 57° Fahrenheit (F). However, the volatility of sulfur mustard is intermediate between that of GB and VX, and at warmer temperatures (above 80° F), sulfur mustard may exhibit a significant vapor pressure. For all of these reasons, sulfur mustard should be considered hazardous by either vapor inhalation or by vapor/liquid contact with the skin and mucous membranes.

D–3. Toxicology

a. Mustard is a vesicant. Besides cutaneous redness and vesication, it—

(1) Produces eye injuries and damage to the respiratory tract.

(2) May be absorbed systemically and cause damage to organ systems with rapidly growing cells that are remote from the site of absorption.

b. The principal cause of injury is the alkylating effect of mustard. The two side chains of sulfur mustard, in the presence of a polar solvent (for example, water), cyclize and become biologically very active. These two chains can attach to two other molecules and specifically bind to the guanine nitrogen in DNA strands, causing cross-linking of DNA and eventually cellular death. Because of the effects on DNA, cell lines with rapid turnover are most affected by the systemic uptake of mustard (for example, the bone marrow and gastrointestinal (GI) tract). Skin sensitization occurs, so individuals with a previous mustard exposure may be affected to a greater degree upon a second exposure.

c. The rate of detoxification of mustard in the human body is slow. Hence, repeated small exposures may have a cumulative effect.

d. Eye absorption results in injuries ranging from mild conjunctivitis to corneal necrosis and opacification. Infection of the ocular lesions is common.

e. Skin absorption of mustard vapor results initially in capillary hyperemia and dermal edema, usually followed by vesication. Skin contact with liquid mustard produces a more marked reaction, often yielding an area of tissue necrosis without vesication, surrounded by an area of erythema and blisters. The skin effects of mustard agent are dependent on the concentration of the agent and the environmental conditions; a hot, humid atmosphere promotes the most severe reactions.

f. Inhalation of mustard causes damage primarily to the nasopharygeal, laryngeal and tracheobronchial mucosa. Moderate exposure results in hyperemia and necrosis of the respiratory mucosa. More severe exposures yield congestion of the pulmonary parenchyma, edema, and atelectasis. Suppurative bronchitis or bronchopneumonia frequently complicates pulmonary lesions and may be the primary cause of death from vapor exposures. Repeated exposures or prolonged inhalation can cause bronchiectasis or chronic bronchitis.

g. If ingestion of mustard occurs, either directly or from liquid-contaminated food or drink, necrosis and desquamation of GI mucosa occurs, producing diarrhea, GI hemorrhage, nausea, and vomiting.

h. Systemic effects can occur after any exposure with much individual variation. Like other alkylating agents, systemic absorption results in injury to the bone marrow, lymph

nodes, and spleen producing leukopenia and thrombocytopenia. Other systemic effects include—

(1) Fever.

(2) CNS depression.

(3) Parasympathomimetic effects (bradycardia or cardiac irregularities).

(4) Hemoconcentration.

(5) Shock.

i. In addition to its direct cytotoxic effects, mustard has also been shown to be mutagenic and carcinogenic in animals. Prolonged human exposure has been associated with cancer of the tongue, paranasal sinus, larynx, bronchus, lung, and mediastinum. Tumors observed have been of the squamous or undifferentiated cell types. Consider the possibility of skin cancer because of the frequency of this lesion in animal studies.

j. Since sulfur mustard agent is similar in its effects to nitrogen mustard, which has been associated with human leukemia, this disease might also be expected to occur in humans chronically exposed to mustard.

D–4. Signs and symptoms

a. The acute signs and symptoms following mustard exposure are not immediate—they are delayed in appearance. The duration of the latent period and the degree of injury are both dependent on the severity of the exposure as well as the organs affected. The delay of onset is typically 4 to 6 hours but may range from less than 1 hour up to several days.

b. The eye is the most sensitive organ system and may become inflamed at mustard concentrations, which do not affect the skin or respiratory tract significantly. Mustard

agent conjunctivitis may be present with lacrimation, grittiness in the eye, and erythema of the lids and conjunctiva. More severe exposures may produce—

(1) Photophobia.

(2) Blepharospasm.

(3) Pain.

(4) Corneal erosions.

(5) Iritis.

(6) Conjunctival vascularization.

(7) Ulceration.

(8) Corneal opacification.

c. Skin exposure to mustard vapor is marked by the delayed appearance of erythema and edema, later followed by the development of vesication or blisters. Itching and burning may occur during the erythematous phase. Multiple small vesicles arise in the erythematous skin and gradually enlarge and coalesce to form typical large, fragile, yellowish bullae. These are usually painless. Liquid mustard contamination of the skin may result in an area of gray-white necrotic skin surrounded by erythema and vesication.

d. Respiratory effects of mustard occur as a result of vapor or aerosol exposures, with the onset time and intensity related to the degree of exposure. The airway injury associated with mustard exposure involves inflammation of the respiratory mucosa in the upper and lower airways. This damage begins in the upper airways and descends to the lower airways in a dose-dependent manner. Upper airway problems include damage to the epithelial lining of the nose, sinuses, pharynx, larynx, trachea, and bronchi. Usually, the terminal bronchioles and alveoli are affected only after a very large inhalation

exposure; this is usually a pre-terminal event. Severe exposure leads to deeper damage involving the connective tissue and smooth muscle of the airways. Early changes to the epithelium include congestion with edema, hyperemia, and petechial hemorrhages, followed by necrosis, and later sloughing of the mucosa with more severe exposures. During the later reparative stages, metaplastic stratified squamous epithelium covers the damaged surfaces.

e. Central airway involvement with mucosal inflammation and necrosis may progress to pseudomembrane formation. These membranes, much like those seen with diphtheria, may peel off and obstruct more peripheral airways. Bronchoscopy may be necessary for removal of the sloughed membranes. Small airway and/or central airway inflammation will lead to a severe hacking cough with prominent dyspnea.

f. After the initial inhalation of mustard, damage to lung tissue leads to congestion, edema, and in severe cases, a chemical pneumonia over the first 24 to 48 hours. These changes are accompanied by an increase in the white blood cell (WBC) count, a mild temperature elevation, and pulmonary infiltrates. Some 2 to 4 days later, signs of bacterial infection may occur, with a higher WBC count, a shift in the differential, new infiltrates, and a change in sputum production with purulence. There may also be areas of airway collapse in severe cases.

g. Gastrointestinal effects of intense mustard exposures include nausea and vomiting. These effects are thought to be in part cholinergic. There may be some added effect of mustard swallowed from ingested, contaminated water (for example, the sailors in Bari Harbor) or from swallowed tracheal secretions, which have trapped some mustard.

h. Central Nervous System effects are occasionally seen with fatigue, depression, anxiety, and agitation. It is difficult to separate CNS effects from mustard exposure versus the post-traumatic stress syndrome.

i. As an alkylating agent, sulfur mustard may have potent bone marrow effects. There is an initial leukocytosis followed by progressive effects on rapidly proliferating cells of the hematopoetic system. Leukopenia begins to appear at 3 to 5 days post-exposure with WBC count approaching zero by 7 to 10 days for severely exposed individuals. Systemic absorption of mustard may be sufficient to create a profound leukopenia with associated sepsis/pneumonitis and death. A leukopenia of less than 200 WBCs per cubic millimeter is a bad prognostic sign. Death from pneumonitis usually occurs at 8 to 10 days with some scattered cases up to 2 to 3 weeks.

j. Chronic mustard-induced illness is most commonly referable to the eyes, skin, respiratory tract, or bone marrow.

(1) Delayed, recurrent keratoconjunctivitis of the eyes has been documented in some cases as long as 45 years after the original exposure.

(2) Healing of mustard blisters may result in skin exfoliation and may leave residual areas of hypo- or hyperpigmentation; rarely, there may be residual scarring in places where deeper burns have occurred or where skin grafting was attempted prematurely.

(3) Dyspnea, productive cough, loss of exercise tolerance, frequent pulmonary infections, chronic bronchitis, bronchiectasis, and changes in pulmonary function tests may indicate possible mustard-induced chronic lung disease.

(4) The development of leukoplakia, masses, or ulcerations that fail to heal on the skin or in the upper respiratory tract may indicate carcinoma. Other respiratory tract

symptoms, such as chest pain, dyspnea, cough, hemoptysis, or hoarseness, could also suggest a respiratory tract malignancy.

(5) Findings consistent with leukemia may also occur. These include lymph node enlargement, purpura, anemia, weakness, fever, frequent infections, splenomegaly, and leukopenia. (NOTE: The latent period for mustard-induced carcinoma or leukemia is likely to be twenty years or greater following exposure.)

D–5. Diagnosis and treatment

a. The diagnosis of sulfur mustard exposure in the workplace is primarily a clinical exercise, based upon the history of exposure, clinical signs, symptoms, and the time course between exposure and onset of symptoms. Confirmatory tests, such as the urinary thiodiglycol assay, may be helpful if they are positive. However, this assay may be non-diagnostic for very mild dermal exposures and has never been used to confirm purely inhalational exposures. When a patient presents with erythema and blisters, it is important to rule out other items in the differential diagnosis, such as—

(1) Delayed hypersensitivity (type intravenously) allergic contact dermatitis.

(2) Contact irritation.

(3) Contact urticaria syndrome.

b. The urinary thiodiglycol assay may be very helpful, particularly for dermal exposures resulting in erythema or vesication affecting greater than 1 percent of the body surface area. Mustard is hydrolyzed and metabolized to thiodiglycol in the body and excreted in the urine. The immediate collection of urine followed by the collection of urine specimens on days 1, 2, 3 and 7 following exposure will allow the clinician to

quantify the amount of thiodiglycol excreted, its half-life in the body, and excretion kinetics. Generally, urinary thiodiglycol excretion peaks 48 to 72 hours after exposure, with a first order half-life of elimination of between 1 and 1.5 days. This assay is very specific for sulfur mustard, but requires specialized gas chromatography/mass spectrometry (see TB MED 296, Chapter 2).

c. Decontamination of mustard-exposed casualties, either vapor or liquid, should be accomplished in the field or the demilitarization facility within the first two minutes following exposure to prevent cellular damage. If not accomplished within the first several minutes, decontamination should still be performed to ensure any residual liquid mustard is removed from the skin or clothes or to ensure any trapped mustard vapor is removed with the clothing. Removing trapped mustard vapor will prevent vapor off-gassing or subsequent cross-contamination of other healthcare providers or the healthcare facility. Physical removal of the mustard agent, rather than detoxification or neutralization, is the most important principle in patient decontamination. Mustard is not detoxified by water alone and will remain in decontamination effluent (in dilute concentrations) if hydrolysis has not taken place.

(1) Vapor-exposed casualties should be decontaminated by removing all clothing in a clean air environment and shampooing or rinsing the hair to prevent vapor off-gassing.

(2) Liquid-exposed casualties should be decontaminated by—

(a) Washing in warm or hot water at least three times. Use liquid soap (dispose of container after use and replace), copious amounts of water, and mild to moderate friction with a single-use sponge or washcloth in the first and second washes. Scrubbing of exposed skin with a brush is discouraged, because skin damage may occur which may

enhance absorption. The third wash should be a rinse with copious amounts of warm or hot water. Shampoo can be used to wash the hair. The rapid physical removal of a chemical agent is essential. If warm or hot water is not available, but cold water is, use cold water. Do not delay decontamination to obtain warm water.

(b) Rinsing the eyes, mucous membranes, or open wounds with sterile saline or water.

(3) The healthcare provider should—

(a) Check the casualty after the three washes to verify adequate decontamination before allowing entry to the military treatment facility. If the washes were inadequate, repeat the entire process.

(b) Be prepared to stabilize conventional injuries during the decontamination process. Careful decontamination can be a time consuming process. The health care provider may have to enter the contaminated area to treat the casualty during this process. In industrial operations, such as demilitarization plants, the proximity of medical support allows medical personnel to arrive at the injury site early in the decontamination process. In this case, medical personnel should don proper PPE and evaluate the exposed workers. This will allow for early diagnosis and treatment if required and will facilitate psychological support to the worker.

d. Erythema may appear as early as 2 or as late as 24 to 48 hours after exposure, depending on the intensity of exposure. For mild erythema, no treatment is usually needed. It is much like mild sunburn with the same recovery time. The objective is to prevent secondary infection. More marked erythema with associated pain and itching needs treatment much as for a moderate to severe second-degree sunburn. Systemic

analgesics for pain and antihistamines for itching should be provided for symptomatic relief.

e. Small blisters in non-critical areas should be left intact. If the blister is about to rupture, use a good aseptic technique to drain the blister and cover it lightly with a sterile dressing. Antibiotic ointment, such as silver sulfadiazine, should be applied to larger lesions to prevent infection. The blister fluid itself is not a vesicant. For crops of blisters or large areas of vesication, hospitalization may be required, and frequent, careful debridement of the affected areas is needed. Whirlpool baths may be useful in the routine care of mustard burns. Skin healing may take weeks to months.

f. Unlike thermal burns, chemical burns do not require large amounts of fluid replacement. Do not over hydrate; however, some fluid replacement is needed since the patients frequently do not drink adequate amounts of fluids to stay hydrated.

g. The main goals of eye treatment for mustard exposed victims are to prevent infection, corneal scarring, and loss of vision. Since mustard fixes to tissue within the first 2 minutes after exposure, irrigation of the eyes with saline during this timeframe is helpful in removing any remaining mustard around the eyelids, on the face, or on the eyelashes. In most cases, however, affected individuals will present for medical attention much later than the first 2 minutes following exposure, after developing signs and symptoms of exposure. In these cases, aggressive attempts to pry apart severely painful, blepharospastic eyelids to accomplish irrigation is of questionable value, it may create unnecessary physical and emotional trauma.

h. Early assessment of the patient's visual acuity is important, and a careful examination of the cornea and conjunctivae membranes with a slit lamp (whenever possible) is also important. Early consultation with an ophthalmologist is also advisable.

i. For mild cases of conjunctivitis, use soothing eye drops or eye irrigation 3 to 4 times daily. Antibiotic ophthalmic drops or ointments are also recommended. A mydriatic, such as homatropine, is recommended to keep the pupil dilated and to prevent the development of synechiae. Vaseline on the eyelid margins is recommended to prevent the lid margins from adhering. Topical analgesics may be used for initial clinical evaluation or to obtain a visual acuity, but are not recommended for repeated use since corneal damage may result. Topical steroids may be helpful if used in the first 48 hours following the injury.

j. The treatment of inhalation exposures to sulfur mustard follows the same precepts that are applied to other inhalation injuries. First priority is given to ensuring the establishment of a patent airway and appropriate airway management. Irritation of the nose, sinuses, and throat, as well as hoarseness or a non-productive cough are early symptoms of airway involvement. These symptoms may progress, depending on the degree of mustard exposure. Bronchospasm may follow, especially for those patients with pre-existing reactive airway diseases such as asthma. In such cases, bronchodilators may be of value. Patients with evidence of worsening symptoms need to have their pO_2 and pCO_2 monitored, and their acid-base status followed closely.

k. Laryngospasm and vocal cord edema should be suspected whenever respiratory stridor or hoarseness is present. Under these circumstances, inspection of the vocal cords may be appropriate, followed by endotracheal intubation. Blind nasotracheal intubation

is not appropriate in this clinical setting. These patients will need adequate oxygenation since there may be associated lower airway disease that will manifest later. Cool mists, with antitussives and soothing demulcents to relieve coughing and airway irritation are useful.

l. Patients with significant inhalation exposures to sulfur mustard may develop a chemical pneumonitis during the first 24 to 48 hours following exposure. Cultures should be done on the sputum to identify any specific organism(s) before starting antibiotics. The immune status of these patients should be evaluated, since leukopenia may develop secondary to bone marrow depression at about 4 to 5 days after a significant mustard exposure.

m. Severe respiratory distress will require supplemental oxygen and assisted ventilation. Care should be taken when hydrating patients with significant body surface area skin burns. Over-hydration of these patients may result in "third spacing" of fluids within damaged lungs and may worsen ventilation/perfusion mismatches. The initial nausea or vomiting that arises during the first 24 to 48 hours following mustard exposures may be treated with antiemetics. Persistent vomiting and diarrhea may require intravenous fluid replacement and the maintenance of electrolyte balance.

Appendix E

Potential Exposure Evaluation Criteria for Mustard Agent Operations

E-1. General

This pamphlet requires medical evaluations be performed in the event of accidental exposure or potential exposure to mustard agents. In the past, the criteria used to identify potential exposures have varied between chemical weapon storage and disposal sites. This variability has led to different implementation criteria for event-driven medical evaluations of these patients. Paragraph 4-7 provided some guidance to the field as to the criteria for conducting potential exposure evaluations during H, HD and HT operations. The criteria for potential exposure evaluations have been developed with input from the field to ensure that medical evaluations of potentially exposed individuals take place whenever the potential for medically significant dermal or respiratory exposure exists.

a. An exposed worker is an individual (working in a mustard agent operating area) who exhibits clinical signs or symptoms of mustard agent intoxication. Confirmation of the clinical diagnosis should be made by looking for the presence of thiodiglycol in the urine, plasma or blister fluid; the presence of DNA adducts in the skin; or the characteristic mustard histopathology on excisional or punch biopsy of affected skin.

b. A potentially exposed worker is an individual who works in a mustard agent operating area where levels of mustard agent either exceed the protective capability of the PPE or are detectable at or above the applicable AEL, and there is a breach in the PPE or a failure of engineering controls.

E-2. Potential exposure policies

These policies apply to all storage, disposal (including stockpile and non-stockpile operations), and laboratory facilities.

a. All operational events meeting the potential exposure criteria shall be reported immediately to the installation commander, chemical activity commander, or the site project manager. Any individual meeting the potential exposure criteria shall be sent immediately to the supporting medical facility for a medical evaluation per paragraph 4-8 and DA Form XX3

b. Potentially exposed personnel should not be returned to duty in a mustard agent operating area until medically cleared by the CMA or their designee.

c. A potential exposure should not be considered a chemical event (see AR 50-6), until the potential exposure evaluation has been completed, and the CMA has rendered a written opinion to the installation commander, chemical activity commander, or site project manager as to exposure effect.

E-3. Procedures for determining potential exposures while wearing PPE

Any individual meeting the potential exposure criteria defined below shall be sent immediately to the supporting medical facility for a medical evaluation per paragraph 4-8 and DA Form XX3. An individual shall be considered potentially exposed:

a. During any entry when mustard agent concentrations exceed the authorized level for the PPE being worn. These levels include:

(1) $\geq$ 50 WPL (0.02 mg/m^3) for M40 respirators.

(2) ≥ 10,000 WPL (4 mg/m^3) for a self-contained breathing apparatus or combination airline respirator with an auxiallary self-contained breathing apparatus worn with encapsulating ensembles other than the DPE.

(3) ≥ 100 mg/m^3 for DPE entries**. (NOTE:** *The National Institute of Occupational Safety and Health has designated the assigned protection factor of 50 for negative pressure, air purifying respirators and 10,000 for self-contained breathing apparatuses. The limit of 100 mg/m^3 for DPE entries is based upon human volunteer testing conducted in 1976.*)

b. During any entry into a mustard agent operating area where mustard vapor is detectable at or above 0.83 mg/m^3 (2,083 WPL) or liquid contamination is known to exist and where a breach or tear occurs in a DPE, modified Army level A, or other equivalent levels of PPE worn with self-contained breathing apparatus or combination airline respirator with an auxiallary self-contained breathing apparatus. *(**NOTE**: The National Research Council, in their monograph entitled Review of Acute Human Toxicity Estimates for Selected Chemical Warfare Agents, suggests 25 mg-min/m^3 as the threshold effects dose for percutaneous vapor under hot temperatures. Using a 30-minute exposure period as a reasonable worst case for breaches in PPE with atmosphere-supplying respiratory protection being worn, a concentration of 0.83 mg/m^3 is established as the dermal threshold for requiring potential exposure evaluations.)*

c. During any loss of engineering controls, upset conditions, or mishaps, which result in an agent concentration of ≥ 1 STEL (0.003 mg/m^3) in areas where the individual was unprotected (that is, no respiratory protection for mustard agents was being worn).

d. During any entry into a mustard agent operating area where an individual develops signs or symptoms consistent with mustard agent exposure effect and where mustard agent vapor is detectable at or above the WPL (0.0004 mg/m^3) or liquid contamination is known to exist.

e. During any DPE cut out in an airlock in which the mustard agent concentration is equal to or exceeds 50 WPL (0.02 mg/m^3), and the DPE wearer is switched from the self-contained breathing apparatus backpack to an M40 respirator.

f. During any entry where DPE life support systems air sampling indicates agent concentrations to be ≥ 1 STEL (0.003 mg/m^3).

Appendix F

Toxicologic Basis for Derivation of Airborne Exposure Limits

F-1. Exposure Criteria

a. Previously established AEL for mustard agents H, HT, and HD were promulgated by the Center's for Disease Control in 1988 (Federal Register, Vol. 53, No. 50, 1988, Pages 8504-8507). A more recent, detailed analysis of sulfur mustard vapor toxicity has been documented in USACHPPM Technical Report 47-EM-3767-01. This report can be viewed at the following website: **http://chppm-www.apgea.army.mil/hrarcp/pages/caw/index.html.**

b. This report provides a detailed discussion of the physical, chemical and toxicologic properties of sulfur mustard and describes the selection of a critical adverse effect and the associated study from which exposure limits are then extrapolated. To establish AEL, the selected critical study for each AEL is used in conjunction with a risk assessment method that includes adjustments for maximal projected exposure duration, estimated dose, and several "uncertainty factors" (UF) to account for data and study limitations. This approach is consistent with current risk assessment models being used by other regulatory agencies when establishing exposure limits/health guidelines for toxic chemicals. The Center's for Disease Control has reviewed the conclusions of this report and endorsed the toxicological basis for the changes to previously existing standards as well as the establishment of newly established AEL. The following paragraphs summarize the information and conclusions drawn from the subject report.

F-2. Discussion and conclusions

Summary of findings.

a. General. Based on the subject technical report, the previously existing AEL for sulfur mustard (HD) have been lowered, and, in addition new types of standards have been provided. However, while this study focused on the application of current toxicologic and risk assessment protocols to calculate specific health guidelines, a general assessment of the application of existing guidelines showed that conservative safety precautions have historically prevented exposures and ensured worker and public health. As an example, existing requirements established that PPE be donned at air concentrations meeting the current WPL (effectively minimizing if not eliminating exposures). As a STEL is actually more appropriate for this application, there is no anticipated need for change in operational requirements. In summary, since existing requirements are already protective, no health effects are expected at the previous action level.

b. HT and H. Though not specifically addressed in the technical report, AEL are also recommended for several related sulfur mustard compounds (HT and H). Due to similar modes of action and toxic response, these sulfur mustard compounds are conservatively assumed to be equipotent to HD, until sufficient agent-specific data become available to adjust this determination. Specifically, H is undistilled, and unstable sulfur mustard (considered 70 percent sulfur mustard plus 30 percent sulfur impurities), and HT is products of a reaction that yields about 60 percent HD, < 40 percent T (chemical abstracts service # 63918-89-8), plus a variety of sulfur contaminants and impurities. Mustard agent HT is considered more active than HD, but there are insufficient data to support a separate analysis, it is considered reasonable to accept HD

values for use in making exposure decisions for HT, unless data necessary to perform a separate analysis are available.

c. AEL and technical basis. The referenced report documents the complete technical rationale for the revised and new standards shown in Table F-1. A summary of the technical basis for each of the sulfur mustard standards follows. The key critical effect chosen for each AEL was *ocular effects*, as the data indicate the eyes yield the most sensitive response to vapor exposures of sulfur mustard. However, other effects such as pulmonary effects could be anticipated with exposures exceeding the calculated AEL. Specific critical studies were selected for each AEL based on the most appropriate duration of the study and severity of effects indicated. A separate evaluation of the carcinogenic potential of mustard exposures for the calculated exposure limits was also performed. Though mustard has been designated as a known human carcinogen by the International Agency for Research on Cancer, significant increases in cancer risk have only been proven at exposures that are assumed to be relatively high compared to the calculated AEL concentrations. Estimated increase lifetime cancer risks for repeated exposures at the WPL or GPL levels are in the probability order (1 = 100 percent) of 0.0028 (2.8×10^{-3}) to 0.000003 (3×10^{-6}). This probability would be additive to the average U.S. citizen's probability of developing cancer during a lifetime (probability approximately 0.3 to 0.5).

(1) GPL. The GPL, designed to reflect a safe concentration that the general population could be exposed to on a daily basis for a lifetime without health effects, was recalculated for sulfur mustard compounds through an assessment of the toxicity database for HD, selection of a critical study and endpoint, and application of current scientific risk assessment models. The GPL was calculated using both human and animal data. The available human data involved continuous exposures for a maximum time period of 600 minutes and the application of a composite UF of

300. Use of short-term data requires the assumption of a linear response pattern over the time periods involved and may, to some degree, overestimate the potential effects if the response pattern is not linear (as suggested by the human studies). Even so, the use of available human data would be a protective approach to deriving the AEL for the general population. The fact that the GPL derived from long-term animal data does not differ from that derived using human data supports the conclusion that the calculated GPL is a reasonable estimate and further suggests that the existing GPL should be lowered. This recent calculation also takes into account the methodology for quantitatively assessing carcinogenic risk. The excess cancer risk associated with the newly recommended sulfur mustard GPL is estimated to be in the range of 7×10^{-4} to 3.8×10^{-6}, which is consistent with the range of acceptable risk traditionally assumed in environmental health risk assessments for the general population. Finally, the GPL for HD was previously denoted as a 72-hour limit; however, this was based on historic sampling time requirements. As a clarification, this estimate assumes a 24-hour TWA.

(2) WPL. The WPL is a term now given to the worker 8-hour TWA. The WPL is similar to a Threshold Limit Value as used by industry for other toxic chemicals. It reflects a value that is protective of exposed workers for exposures as long as 8 hours each day, 5 days a week, for a working lifetime. As in the case of the GPL, the WPL for sulfur mustard was calculated using both short-term human exposure data and long-term animal data. The short-term human study involved three 8-hour exposures, one on each of three consecutive days. The effects seen under these test conditions were very mild symptoms of ocular toxicity. Since this exposure frequency is similar to what workers would experience, the data are appropriate for calculating an 8-hour/day, 5 day/week exposure limit. Although the same uncertainties exist in interpreting the results of this exposure in terms of possible cumulative effects following long-term exposures,

data indicate that cumulative effects are less likely if the exposures are separated by a 2 to 3 day exposure-free period. Since workers would experience such a recovery period during weekends, the potential for cumulative effects may be greatly diminished. Nevertheless, additional UFs were used in deriving the WPL from the human data; the composite UF was 100. The WPL derived from the human data is similar to that derived from the long-term animal data. However, the WPL for sulfur mustard as calculated in the subject technical report is a lower WPL than the previous 8-hour TWA. This recent calculation also takes into account the methodology for assessing carcinogens; the excess cancer risk associated with the newly recommended sulfur mustard WPL is in the range of 2.8×10^{-3} to 3.0×10^{-6}, which is more protective than many workplace standards for carcinogenic chemicals.

(3) STEL. The STEL is a type of standard used by industry to establish worker-protection criteria. The exposure level defined by a STEL reflects an atmospheric concentration to which a worker can be exposed for 15 minutes up to 4 times in a day without experiencing irritation, narcosis or escape-impairment or otherwise significant health impacts. No previously established STELs existed for chemical warfare agents. Human exposure data were selected for calculating a STEL for sulfur mustard. Three different approaches at modeling the data gave results within the same order of magnitude (0.003, 0.0036, and 0.0067). This comparison provides a degree of confidence that a STEL of 0.003 mg/m^3 is reasonable and protective. Therefore, for both technical and operational reasons, the recommended STEL for sulfur mustard agent is 0.003 mg/m^3. Use of the STEL as an alarm criterion for the workplace is considered to be a protective approach, since the value of 0.003 mg/m^3 is a factor of 3 below the estimated no-effect concentration of 0.01 mg HD/m^3 for ocular effects.

(4) IDLH. IDLH values for sulfur mustard were not previously established in Army policy. The calculated IDLH is based on human acute toxicity studies. Again the critical effect chosen was ocular effects as data indicate that severe and even permanent ocular damage can occur at sulfur mustard concentrations lower than those producing similar degrees of injury to the respiratory tract. If workplace procedures dictate use of fully encapsulated protective clothing and equipment at the WPL or STEL, there may be limited application for this IDLH.

F-3. Derivation of AEL for mustard agents (WPL, STEL, IDLH, and GPL)

a. USACHPPM Technical Report 47-EM-3767 contains three WPL derivations (summarized in Table F-2) that yield estimates all within the same order of magnitude. These approaches included—

(1) Adjustment of short-term exposure human lowest observed adverse effect level (LOAEL) by Guild et al (1941) (ocular effects).

(2) Adjustment and extrapolation of a no observed adverse effect level (NOAEL) (ocular effects) from a chronic animal study by McNamara et al (1975) that used data from dogs.

(3) Adjustment and extrapolation of a NOAEL (pulmonary effects) from the same chronic animal study (using rat data).

b. For the purpose of establishing occupational exposure criteria, Guild et al (1941) was selected as the primary study. This study included four volunteers who reported "scarcely discernable" eye effects at an exposure concentration of 0.06 mg/m^3 for 8 hours/day for 3 consecutive days. The study exposure concentration of 0.06 mg/m^3 was adjusted by a factor of 3/5 to go from the 8 hour/day, 3-day study period to a full work week of 5 days. Adjusted human-equivalent NOAELs derived from McNamara et al (1975) dog and rat data were

calculated to be 0.003 mg/m^3 and 0.0067 mg/m^3, respectively. The calculation and UF for each data set used to estimate the WPL are summarized as:

$$WPL = \{NOAELK \text{ or } LOAEL\}adj \times \frac{1}{UF_s \times MF}$$

Where--

(1) NOAEL = in mg/m^3.

(2) LOAEL = in mg/m^3.

(3) UF_H = To account for potential human variability in response.

(4) UF_A = To extrapolate from animals to humans.

(5) UF_L = To extrapolate from a LOAEL to a NOAEL.

(6) UF_S = To extrapolate from a subchronic to chronic exposure.

(7) UF_D = To adjust for inadequacies in the database.

(8) MF = Modifying Factor, to adjust for deficiencies in the study

F-4. Derivation of STEL for sulfur mustard

a. The derivation of the STEL documented in USACHPPM Technical Report 47-EM-3767 involves calculations based on three separate studies (Anderson, J.S.(1942); Guild et al (1941); and Reed, C.I. (1918) and Reed et al (1918)) and four different mathematical equations/approaches. A summary of the studies, type of mathematical calculation used to estimate the STEL, and resulting STEL estimate is in Table F-3.

b. The Guild et al (1941) study was selected as the "best" study and the time-weighted adjustment to the LOAEL as the approach most consistent with methodologies used for the other AEL. A conservative STEL of 0.003 mg/m^3 from this study and approach were selected as a conservative STEL that could be alarm criteria, given the latency period associated with effects.

The STEL of 0.003 mg/m^3 is considered adequately protective, since the overall human database studies indicate a threshold (for example, LOAEL) of about 0.1 mg/m^3 for mild ocular effects regardless of the exposure time and a no-effect level (for example, NOAEL) could be estimated at 0.01 mg/m^3 using the standard default UF of 10.

F-5. Derivation of IDLH concentration for sulfur mustard

USACHPPM Technical Report 47-EM-3767 (Nov 2000) bases a derivation of the IDLH for sulfur mustard on a single human study (Anderson, 1942). This study provides a LOAEL (ocular effects for example, conjunctival injection; for which high humidity and temperature can exacerbate). The adjustments and extrapolations are presented below

$$\text{IDLH} = \{\text{LOAEL}\}\text{adj} \times \frac{1}{UF_s \times MF}$$

Where:

a. LOAEL = 1.7 mg/m^3, adjusted for a 30-minute period = 1.7 x 33 min/30 min = 1.9 mg/m^3

b. UF_H = 1, because of assumed generally healthy worker population.

c. UF_A = 1, because human data used.

d. UF_L = 1, because a LOAEL is adequate for IDLH.

e. UF_S = 1, because IDLH is for short, single exposure.

f. UF_D = 1, data considered adequate to adjust for inadequacies in the database.

g. MF = 1, no other uncertainties in study.

Thus,

$$\text{IDLH} = 1.9 \text{ mg/m}^3 = 2.0 \text{ mg/m}^3$$

F-6. Derivation of GPL for sulfur mustard

a. USACHPPM Technical Report 47-EM-3767 (Nov 2000) contains three GPL derivations, each yielding identical GPL estimates. These approaches included—

(1) Adjustment of short-term exposure human LOAEL (Guild et al, 1941) (ocular effects).

(2) Adjustment and extrapolation of a NOAEL (ocular effects) from a chronic animal study (McNamara et al, 1975 using data from dogs).

(3) Adjustment and extrapolation of a NOAEL (pulmonary effects) from the same chronic animal study (using rat data).

b. A single 10-hour human exposure yielding a LOAEL of 0.1 mg/m^3 for mild ocular effects was adjusted to accommodate a 365 day per year exposure scenario; resulting in an adjusted LOAEL of 0.006 mg/m^3. Adjusted human-equivalent NOAELs derived from the McNamara et al (1975) dog and rat data were calculated to be 0.0007 mg/m^3 and 0.0016 mg/m^3, respectively. The calculation and UFs for each data set used to estimate the GPL are summarized below:

$$GPL = \{NOAEL \text{ or } LOAEL\}_{adj} \times \frac{1}{UF_s \times MF}$$

Where:

(1) NOAEL = In mg/m^3.

(2) LOAEL = In mg/m^3.

(3) UF_H = To account for potential human variability in response.

(4) UF_A = To extrapolate from animals to humans.

(5) UF_L = To extrapolate from a LOAEL to a NOAEL.

(6) UF_S = To extrapolate from a subchronic to chronic exposure.

(7) UF_D = To adjust for inadequacies in the database.

(8) MF = To adjust for deficiencies in the study.

Table F-1
Summary of Recommended AEL for Sulfur Mustard Agents (as compared with existing standards)

Agent	GPL mg/m^3	WPL mg/m^3	STEL mg/m^3	IDLH mg/m^3
HD, HT, H	0.00002 ~~0.0001~~[a]	0.0004 ~~0.003~~[a]	0.003 ----[b]	2.0 ----[b]

[a] Existing standard
[b] No existing standard available

Table F-2
Summary of Derivations for WPL

Study	Study Type	LOAEL or NOAEL	UF_H	UF_A	UF_L	UF_S	UF_D	MF	Total Uncertainty	WPL Est mg/m^3
Guild et al (1941)	Human 10-hour single exp.; ocular effects	LOAEL = 0.036	3	1	3	10	1	3	300	0.0004
McNamara et al (1975)	Animal, 5-day/wk 1 yr, ocular effects in dogs	NOAEL = 0.003	1	3	1	1	1	3	10	0.0003
McNamara et al (1975)	Animal, 24-hr-5-day/wk 1 yr, pulmonary effects rats	NOAEL	1	3	1	1	1	3	10	0.0007

Table F-3
Summary of STEL Estimated Values (mg/m^3)

Study	Key Study Information	Minimal LOAEL Approach	Time-Adj. LOAEL Approach	Probit Approach	Logistics Approach
Reed et al (1918)	5 human subjects; previously sensitized by relatively high exposures	--	--	0.0309	0.0669
Anderson et al (1942)	3 human subjects; 3 responses; conjunctival injection	0.09	--	--	--
Guild et al (1941)	4 human subjects; 4 responses; 24-hour latent observation; mild generalized eye effects	0.07	0.0036	--	--

Table F-4
Summary of Derivation of GPL

Study	Study Type	LOAEL or NOAEL	UF_H	UF_A	UF_L	UF_S	UF_D	MF	Total Uncertainty	GPL Est. mg/m^3
Guild et al (1941)	Human 10-hour single exp., ocular effects	0.006	3	1	3	10	1	3	300	0.00002
McNamara et al (1975)	Animal, 5-day/wk; 1 year ocular effects in dogs	0.0007	3	3	1	1	1	3	30	0.00002
McNamara et al (1975)	Animal 24 hour-5-day/wk, 1 year; pulmonary effects in rats	0.0016	10	3	1	1	1	3	100	0.00002

GLOSSARY

Section I
Abbreviations

AEL
Airborne exposure limit

CBC
complete blood count

CMA
competent medical authority

CNS
central nervous system

DNA
deoxyribonucleic acid

DPE
demilitarization protective ensemble

EKG
electrocardiogram

GI
gastrointestinal

GPL
General population limit

IDLH
Immediately dangerous to life or health

LOAEL
lowest observed adverse effect level

MF
modifying factor

mg/m^3
milligram(s) per cubic meter

MH
medical history

MSDS
material safety data sheet

NOAEL
no observed adverse effect level

NRT
near real-time

OH
occupational history

OSHA
Occupational Safety and Health Administration

PE
physical examination

PPE
personal protective equipment

PRP
personnel reliability program

STEL
Short term exposure limit

SOP
standing operating procedure

TWA
time-weighted average

UF
uncertainty factor

USACHPPM
U.S. Army Center for Health Promotion and Preventive Medicine

WBC
white blood cell

WPL
Worker population limit

Section II
Terms

Agent area
A physical location where entry and exit are restricted and controlled and where agents H, HD, or HT are manufactured, processed, packaged, repackaged, demilitarized, released, handled, stored, used, and/or disposed.

Agent H
The chemical called Levinstein mustard, consisting of a mixture of 70 percent bis(2-chloroethyl) sulfide and 30 percent sulfur impurities produced by the Levinstein process.

Agent HD
The chemical called distilled mustard or bis(2-chloroethyl) sulfide, chemical abstract service registry No. 505-60-2. HD is H that has been purified by washing and vacuum distillation to reduce sulfur impurities.

Agent HT
A vesicant mixture that consists of 60 percent bis(2-chloroethyl) sulfide and 40 percent bis(2-chloroethylthioethyl) ether, chemical abstract service registry No. 63918-89-8.

Agent operating area
Portion of an agent area where workers are actively conducting mustard agent operations.

Agent worker
An individual assigned to exposure category A, B, C, or D.

Airborne exposure limits
Allowable concentrations in the air for workplace and general population exposures. AELs include WPLs, STELs, IDLHs, and GPLs.

Ceiling value
Normally refers to the maximum exposure concentration at any time, for any duration. Practically, it may be an average value over the minimum time required to detect the specified concentration. The IDLH values for mustard agents are considered a ceiling value for the purpose of requiring the use of a self-contained breathing apparatus.

Certifying official
For military and DA civilian personnel, the immediate commander (or, if civil service, the director) who is responsible for the operation or security, or both, of chemical weapons or materiel. If the commander or director is a colonel or a GM/GS-15, or above, he or she may delegate subordinates to act as organization certifying officials. Such designees should be supervisors who can feasibly cause sufficient personal contact to be maintained with personnel to continually evaluate them. For Army contractor personnel, the Army Contracting Officer's Representative is usually designated in the contract as the certifying official. The certifying official certifies that personnel being considered for assignment to chemical surety duties meet the qualification requirements of the chemical PRP.

Contract Medical Director
U.S. civilian physician under contract to provide occupational health services to employees at U.S. Government-owned facilities.

Exposed worker
An exposed worker is defined as an individual (working in a mustard agent operating area) who exhibits clinical signs or symptoms of mustard agent intoxication. Confirmation of the clinical diagnosis should be made by looking for the presence of thiodiglycol in the urine, plasma or blister fluid; the presence of DNA adducts in the skin; or the characteristic mustard histopathology on excisional or punch biopsy of affected skin

Exposure Potential
Refers to workplace conditions in which mustard agents may be present in a liquid or vapor form, in varying quantities and concentrations, due to the nature of industrial, training or laboratory operations.

Potentially exposed worker
A potentially exposed worker (see criteria in Appendix E) is an individual who works in an agent operating area where levels of mustard agent—

a. Exceed the protective capability of the PPE.
b. Are detectable and there is a breach in PPE or engineering controls.

Written Recommendation for Use of Respiratory Protective Devices

I have completed a medical evaluation of _____
for the use of the respiratory device(s) listed on DA Form XX2 and in compliance with 29 CFR 1910.134 effective April 8, 1998. Based upon my evaluation, I find that this individual (click) able to wear these device(s) in a safe and healthful manner. I (click) identified the following limitations on the use of these respirator:

In my judgement, this individual (click) require a follow-up medical examination to make a final determination as the their ability to wear the respiratory protective devices listed above.

The individual named above has been given a copy of this written recommendation and has been advised to request a follow-up medical evaluation if he or she develops medical signs or symptoms, which impair (click) ability to safely us this respiratory protective device as intended.

SIGNATURE	TITLE OF HEALTHCARE PRACTITIONER	16. DATE

DA FORM XX1, OCT 02

MEDICAL CLEARANCE FOR RESPIRATOR USE	1. DATE 11 Feb 03

PRIVACY ACT STATEMENT
AUTHORITY:
PRINCIPAL PURPOSE:
ROUTINE USAGE:
DISCLOSURE:

2. NAME	5. SSN *(digits only):*
	6. SEX:
3. JOB TITLE	7. HEIGHT *(digits only):*
4. EMPLOYER	8. WEIGHT *(digits only):*
	9. DOB *(ddmmmyy)*:

10. TYPE OF RESPIRATOR USED (selected all that apply)	11. LEVEL OF WORK EFFORT (select one)	12. EXTENT OF USAGE	14. SPECIAL WORK CONSIDERATION (that is, high places, temperatures, or protective clothing)
___ Full-face negative pressure air purifying ___ Powered air purifying respirator ___ Emergency escape device ___ Other (list) _____	___ Light ___ Moderate ___ Heavy ___ Strenuous	___ Daily ___ Occasionally ___ Rarely- or in emergency escape purposes	_____
	13. LENGTH OF TIME OF ANTICIPATED EFFORT IN HOURS		

15. SIGNATURE	16. DATE

DA FORM XX2, OCT 02

POTENTIAL EXPOSURE EVALUATION DATA SHEET AND CLINICAL RECORD

SECTION I

1a. Last Name | 1b. First Name | 1c. MI

2. Symtomatic? ☐ NO ☐ YES *(describe)*

3. Chemical Agent Exposure Information *(select all that apply)*

a. AGENT: ○ GB ○ VX ○ HD

b. PHYSICAL STATE: ○ Vapor ○ Liquid

c. POTENTIAL ROUTE: ○ Eye ○ Inhalation ○ Skin

4. Level of PPE worn: *(select all that apply)*

○ Level A ○ Level B

○ Tapes ○ Mask ○ Gloves ○ Boots

○ Apron ○ Slung mask ○ Overalls ○ Impregs

○ Other: _____

5. Exposure Time:

a. Estimated time of exposure: _____

b. Duration of exposure/potential exposure: _____

b. Time elapsed since initial event: _____

6. Estimated concentration of agent in workplace where exposure occurred *(if known)*:

_____ mg/m3 **or** _____ X TWA

7. Was the detection of agent confirmed by a second means of detection? ☐YES ☐NO ☐PENDING

8. Has the exposed or potentially exposed work:

a. Changed and removed clothing? ☐YES ☐NO

b. Been showered or decontaminated? ☐YES ☐NO

c. Received any treatment? ☐YES ☐NO

9. If treatment has been received, please describe:

10. Information received from:

11. Name of clinic personnel recording data:

12. Date data was recorded | 13. Time data was recorded

SECTION II

1. Date | 2. Time | 3. PRP Notification ☐

4. Vital Signs

Body Temp _____

Blood Pressure _____

Pulse Rate _____

Respiratory Rate _____

Body Weight _____

5. Potential Agent

☐ GB ☐ VX ☐ Other

6. Review of Systems

	NO	YES		NO	YES
Dim Vision	☐	☐	Runny Nose	☐	☐
Blurred Vision	☐	☐	Dyspnea	☐	☐
Eye Pain	☐	☐	Chest Tightness	☐	☐
Headache	☐	☐	Coughing	☐	☐
Nausea	☐	☐	Wheezing	☐	☐
Vomiting	☐	☐	Sweating	☐	☐
Diarrhea	☐	☐	Weakness	☐	☐

7. Chief complaint/exposure history:

8. Physical Exam

EYE:	NO	YES (DESCRIBE)
Lacrimation	☐	☐ _____
Conjunctival Redness	☐	☐ _____
Blepharospasm	☐	☐ _____
Adnormal Pupil Reactivity	☐	☐ _____
Pupil Size		
RESPIRATORY:		
Stridor	☐	☐ _____
Wheezes	☐	☐ _____
Rhonchi	☐	☐ _____
Rhinorrhea	☐	☐ _____
Bronchorrhea	☐	☐ _____
Salivation	☐	☐ _____
SKIN:		
Sweating	☐	☐ _____
NEUROMUSCULAR:		
Fasciculations	☐	☐ _____
Twitching	☐	☐ _____
Weakness	☐	☐ _____

9. Other findings:

10. Baseline ChE: | 11. Current ChE: | 12. Date/Time:

13. Impression.

14. Plan.

15. CMA Signature | 16. Date 11/02/03 | 17. CMA Stamp

DA FORM XX3, OCT 02